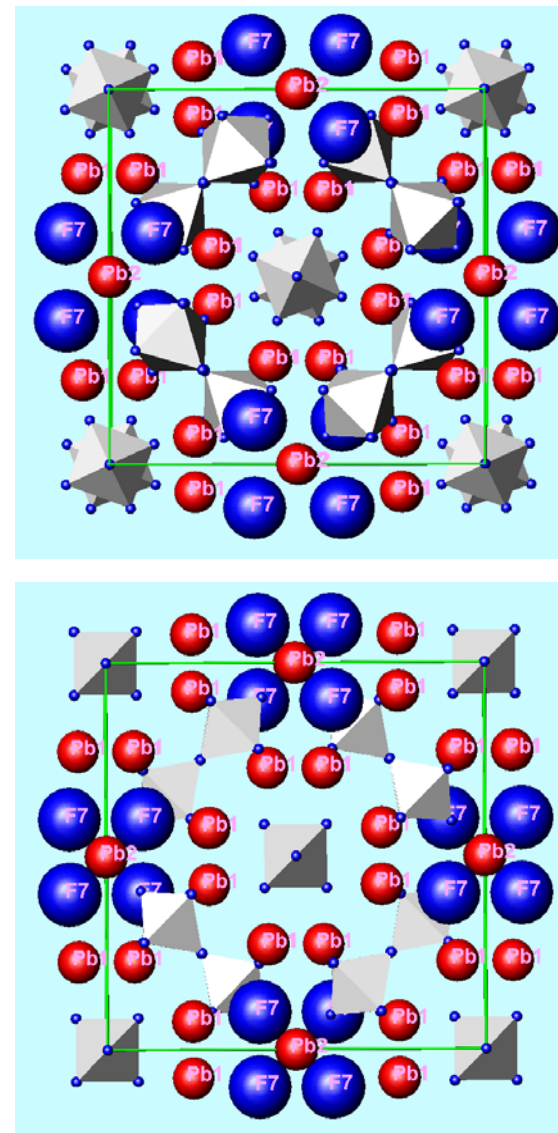


Structure-property correlation over five phases and four phase transitions in $\text{Pb}_5\text{Al}_3\text{F}_{19}$

S. C. Abrahams, J. Ravez, H. Ritter and J. Ihringer
Southern Oregon University, DMR-0137323

$\text{Pb}_5\text{Al}_3\text{F}_{19}$ is the the only fluoride known to form five stable phases under ambient pressure. The structural equilibrium of phases II – IV is disturbed by the addition of $3d$ electrons, with only phases I and V stable in the presence of more than about half a $3d$ electron per octahedron. The calorimetric, dielectric and ferroic properties of pure $\text{Pb}_5\text{Al}_3\text{F}_{19}$ have been correlated with the structure of each phase and with the changes that take place at each transition. The upper figure shows the atomic arrangement at 160 K in the lowest temperature ferroelectric phase, the lower shows the prototype atomic arrangement at 670 – 825 K. Phase II is antiferroelectric, phase III is ferroelastic.

Acta Cryst. (2003). B59, 557-574.



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Education:

Professor Dr. Jörg Ihringer of the Lehr- und Forschungsbereich für Röntgen- und Neutronenbeugung der Universität, Tübingen, Germany, Dr. Jean Ravez, Director, CNRS, Institut de Chimie de la Matière, Bordeaux, France and Dr. Harald Ritter, post-doctoral fellow at the Forschungsbereich für Röntgen- und Neutronenbeugung, Tübingen, Germany participated in this international collaboration that began during a second visit to Tübingen in 1995 as an Alexander von Humboldt prizewinner.

Outreach:

Eric R. Ylvisaker and Robert J. Yager were in their senior year as physics majors, with Russell Weigel and Jason Stephens in their junior year, at SOU last summer while Robert Black is a science teacher at North Medford High School and Mateo Mengis was a student in his junior year at the same school. All six worked on our search for new ferroelectrics. Russell and Jason are continuing their research this academic year, the results of which will be presented in their capstone theses. Eric and Robert will enter graduate school.